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B5N N0324 N0702 N175 N177 N180 N195 N196 N207 N21Y N210 N223 N225 N237 N255 N259 N26X N261 N263 N2708 N2732 N401 N418 N42X N420 N46X N49Y N490 N507 N509 N518 N53X N53Y N530 N558 N577 N58X N58Y N580 N591 N661 N672 N734 N738 N78X
B2E EKA E1728 E444T E473T E474S E482S E553T E626S E626T
U1S S1278 S1279 S1814

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(54) Abstract Title
Gas-permeable sealing film

(57) A gas-permeable sealing film comprising a gas-permeable barrier layer and a sealing layer, wherein the sealing layer is adapted to attach the sealing film to an object without substantially reducing gas-permeability of the barrier layer. The sealing layer may be perforated (figure 1) or be in the form of an open mesh or net (figure 2) or laminated to a sealing region of the barrier layer such that a substantial portion of the barrier layer remains exposed (figure 3). The gas permeable layer may be OPP or OPS. The sealing layer may be polyester or polyethylene. Such films are useful for preserving high-moisture content foods in the retail food industry.

FIGURE 2

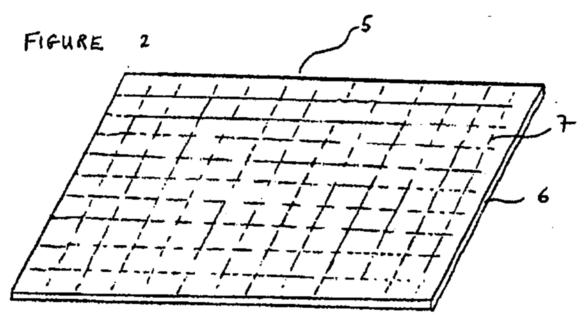

FIGURE 1

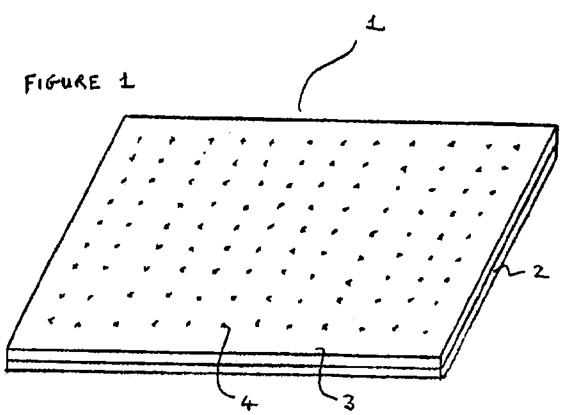

FIGURE 3

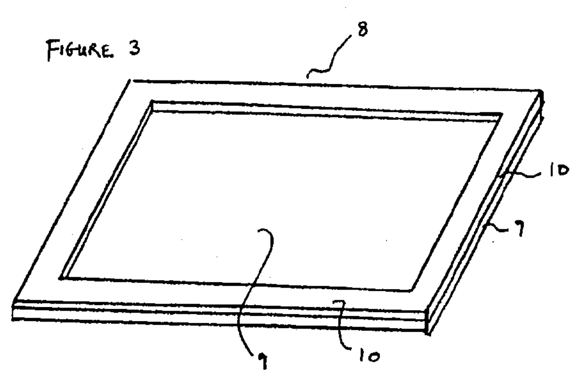

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FIGURE 1

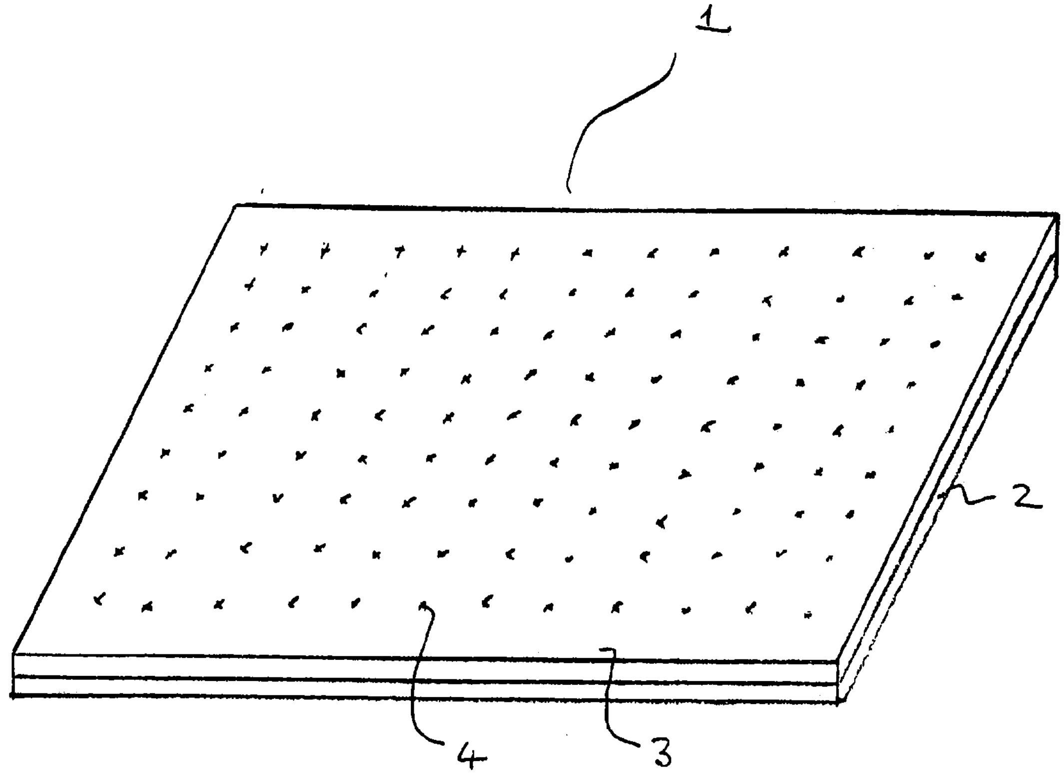


FIGURE 2

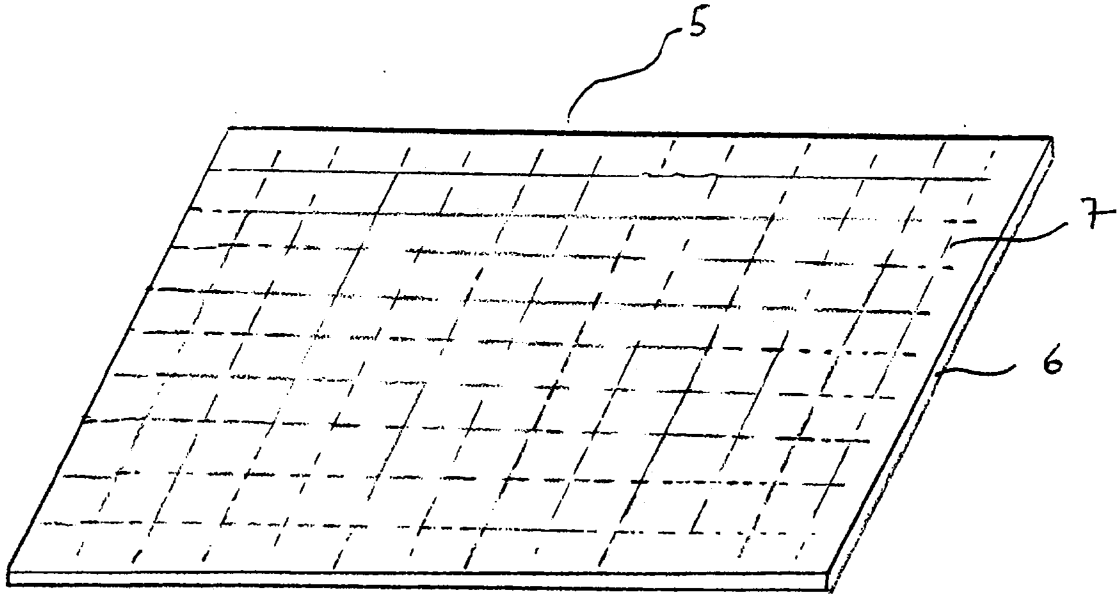
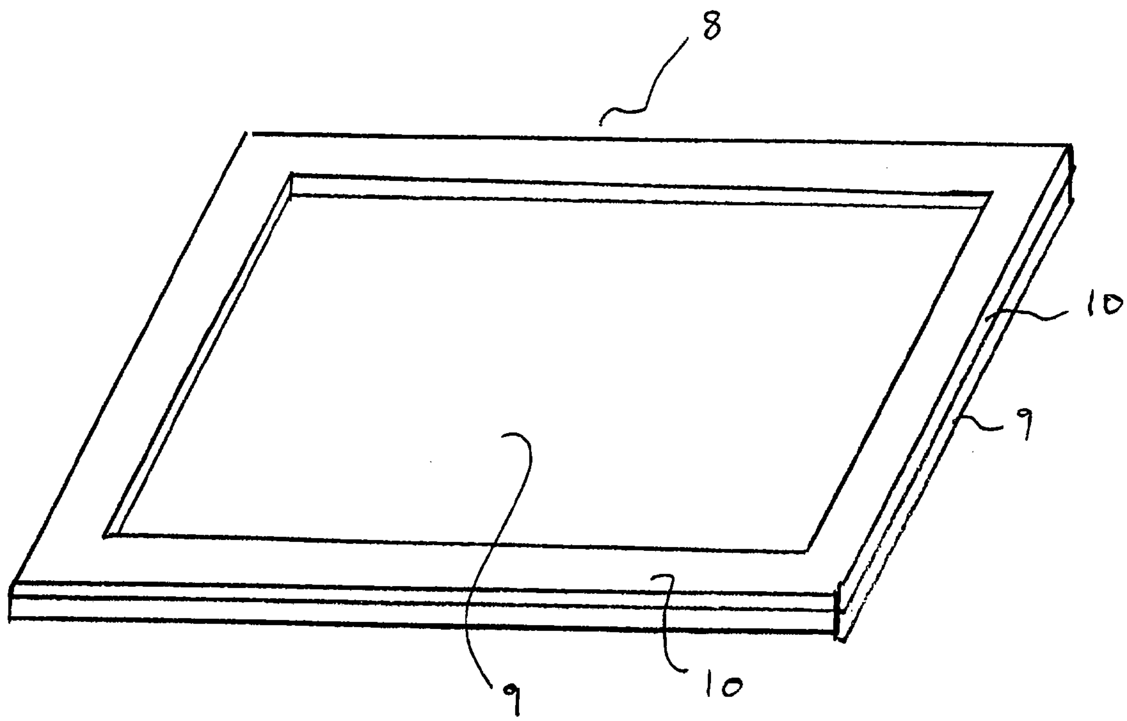


FIGURE 3



GAS-PERMEABLE SEALING FILM AND METHOD FOR MAKING THE SAME

Description

The present invention relates to gas-permeable sealing films and to a method for making the same. Such films are particularly useful for preserving fruit, vegetables and other high-moisture content foods in the retail food industry.

Freshly-cut uncooked vegetables as well as certain whole fruit and vegetables, such as mushrooms, absorb oxygen and release carbon dioxide on storage. Water vapour is also released, particularly from those vegetables having a high-moisture content. This process, which can be called ripening, leads to degradation of the product and, thus, to a gradual reduction in its shelf-life. It is well-known that, if the rate of gaseous exchange can be slowed down, the shelf-life of the product will generally be enhanced. The most common way of achieving this is to produce a film that can be used to carry out the relevant packaging function, such as a film that can be used as lidding for food trays or a film suitable for form, fill and seal applications, and to micro-perforate it so as to allow gaseous exchange to occur through the film. The number of perforations in the film and, thus, its gas-permeability are usually selected to allow around 50% of the gaseous exchange that would occur if the product were left uncovered. Such packing films slow down the rate of gaseous exchange of the product and, thus, enhance its shelf-life. However, as such films are perforated, they cannot provide a barrier to microbes and there is still a risk that the product may become contaminated, the risk being proportional to the degree of perforation. Since different vegetables undergo gaseous exchange at different rates, therefore, it is has become accepted practice to use films having different numbers of perforations for different applications, the number of perforations being matched to the rate of gaseous exchange of the relevant product. Typically, a vegetable packer might use films having oxygen transmission rates which vary from 1,500 $cm^3/m^2/day$ to 50,000 $cm^3/m^2/day$ and, consequently, the packer might have to have as many as 8 to 10 different packing films in his armoury. This has a number of disadvantages. First, there is often confusion as to which film must be used for which product. Secondly, the presence of any perforations in the sealing film still

allows microbes to enter the pack. Thirdly, whilst gas transmission is accurately controlled by the perforations, moisture transmission is totally ignored, and it has been found by the present inventor that the rate of moisture transmission can be equally important in enhancing the shelf-life of certain vegetables. One possible solution would be to use a packing film having the desired gas-permeability but which is not perforated. For example, oriented polystyrene film (OPS) has an oxygen transmission rate of 6,000 $cm^3/m^2/day$ and a moisture transmission rate of 150 $gm/m^2/day$. Although OPS has excellent gas-permeability, however, it has poor sealing properties and, thus, cannot be used as a packing film. Moreover, OPS cannot be coated or laminated with a conventional sealing film without a drastic reduction in its own gas-permeability, thus making the resultant film unfit for its intended purpose. It is an object of the present invention to overcome some of these disadvantages by providing a film having the desired gas-permeability and sealing characteristics, whilst still providing a barrier to microbes.

Accordingly, in a first aspect of the invention, there is provided a gas-permeable sealing film comprising a gas-permeable barrier layer and a sealing layer, wherein the sealing layer is adapted to attach the sealing film to an object without substantially reducing gas-permeability of the barrier layer. In the context of the invention, the term "gas-permeable barrier layer" is understood to refer to barrier layers that are permeable to most common gases, such as oxygen, carbon dioxide or water vapour, but which are substantially impermeable to other substances, such as microbes, thereby providing a barrier to the latter. This represents a departure from most conventional sealing films used in the food industry, which are intended to slow down the rate of gaseous exchange with the product in question, whilst providing only a limited degree of physical protection. Any suitable gas-permeable barrier layer may be used, although oriented polystyrene (OPS) and oriented polypropylene (OPP) films have been found to give particularly good results. However, a wide range of gas-permeable films having an equally wide range of physical properties is available, and any of these can be selected depending upon the desired application. In most circumstances, the sealing layer will overlay at least a portion of the barrier layer, although it is envisaged that there will be occasions where this is not the case and the latter are also intended to lie within the scope of the present invention. In a

preferred embodiment, the sealing layer is substantially completely porous, such that the gas-permeability of the sealing film is determined mainly by the gas-permeability of the barrier layer. Preferably, the sealing film retains at least 70%, preferably at least 80%, most preferably at least 85%, of the gas-permeability of the barrier layer alone. In this embodiment, the sealing layer may be porous when it is formed or may be rendered porous subsequently. In a preferred embodiment, the sealing layer is perforated, preferably micro-perforated, for example, by piercing the layer with a spiked tool. Alternatively, the sealing layer may be perforated or rendered porous when it is formed, for example, by selecting a suitable polymeric precursor, poring the precursor into a spiked mould, setting the precursor, and removing the perforated sealing layer from the mould. Other methods of rendering the sealing layer porous will be readily apparent to those skilled in the art. In another embodiment, at least a portion of the sealing layer is in the form of an open mesh or net. In the latter case, preferably substantially all of the sealing layer is in the form of an open mesh or net, the barrier layer being supported thereon. This has the advantage that less material is required to form the sealing material, whilst the resultant mesh or net structure helps to provide structural rigidity to the sealing film, as well as permitting sealing. In any of the aforementioned embodiments, the sealing layer will generally be directly attached to the barrier layer, although sealing films having intervening layers of other materials, such as gas-permeable adhesives, are also contemplated. In a preferred embodiment, the sealing layer, or at least a portion thereof, is laminated to the barrier layer. In an alternative embodiment of the invention in its first aspect, the sealing layer is laminated to a sealing region of the barrier layer, such that a substantial portion of the barrier layer remains exposed. In a preferred embodiment, the sealing region forms a peripheral region of the barrier layer, preferably such that at least 70%, preferably at least 80%, most preferably at least 85%, of the barrier layer remains exposed. Thus, if the sealing film is circular in shape, for example, the sealing region of the barrier layer may constitute an annular region at the outer edge of the circle. In a preferred embodiment, the barrier layer is substantially impervious to microbes, such as air-borne bacteria and fungal spores. Preferably, the gas-permeable sealing film has an oxygen transmission rate of from 1,500 $cm^3/m^2/day$ to 50,000 $cm^3/m^2/day$, preferably from 2,000 $cm^3/m^2/day$ to 25,000 $cm^3/m^2/day$, more preferably from

5,000 $cm^3/m^2/day$ to 15,000 $cm^3/m^2/day$. Preferably, the gas-permeable sealing film has a moisture transmission rate of from 1 $gm/m^2/day$ to 1000 $gm/m^2/day$, preferably from 5 $gm/m^2/day$ to 500 $gm/m^2/day$, more preferably from 50 $gm/m^2/day$ to 250 $gm/m^2/day$. The gas-permeable barrier layer may be formed of any suitable natural polymer or synthetic polymer, such as any suitable thermosetting or thermoplastic polymer. However, oriented polystyrene or oriented polypropylene films are especially preferred. Similarly, the sealing layer may be formed of any suitable polymer that has the necessary sealing characteristics, depending upon the desired application. In a most preferred embodiment, the sealing layer comprises a coated polyester film or a polythene film.

In a second aspect of the invention, there is provided a method of forming a gas-permeable sealing film, comprising providing a gas-permeable barrier layer with a sealing layer that is adapted to attach the sealing film to an object without substantially reducing gas-permeability of the barrier layer. In such a method, it is preferred that at least a portion of the barrier layer is overlaid with the sealing layer. Preferably, the sealing layer is substantially porous, such that the gas-permeability of the sealing film is determined mainly by the gas-permeability of the barrier layer. In a preferred embodiment, the method comprises the steps of providing a thin film of a sealing material and perforating the thin film to form a substantially porous sealing layer. Alternatively, the sealing layer is formed of an open mesh or net of a sealing material, for example, by weaving the sealing material. In another equally preferred embodiment, however, the sealing material comprises a thermoplastic polymer that is set in the form of an open mesh or net. In another embodiment of the invention in its second aspect, the sealing layer is applied to a peripheral region of the barrier layer, such that a substantial portion of the barrier layer remains exposed. In most cases, the sealing layer is laminated to at least a portion of the barrier layer, although the sealing layer may be applied to or formed on the barrier layer by other methods, such as, for example, by a partial coating technique.

In a third aspect of the invention, there is provided a gas-permeable sealing film formed by a method according to the invention in its second aspect.

In order that the invention may be better understood, a number of embodiments thereof will now be described, by way of illustration only, and with reference to the accompanying drawings, wherein:

Figure 1 shows a sealing film in accordance with the invention in its first aspect;

Figure 2 shows a sealing film in accordance with a second embodiment of the invention in its first aspect; and

Figure 3 shows a sealing film in accordance with a third embodiment of the invention in its first aspect.

In Figure 1, a sealing film 1 comprises a layer of oriented polystyrene (OPS) film 2 laminated to a layer of polythene 3 provided with a plurality of perforations 4. In use, heavily perforated polythene layer 3 does not greatly affect the permeability of the oriented polystyrene layer 2, although it does help to strengthen it. The resultant laminate 1 can be used to make bags because the polythene can be sealed to itself. In addition, the laminate 1 can be used to seal to polythene trays.

In Figure 2, a sealing film 5 comprises a layer of oriented polypropylene (OPP) film 2 laminated to a sealing layer a mesh of polythene 7. In resultant laminate 5 can be used as described above for sealing laminate 1.

In Figure 3, a sealing film 8 comprises a layer of oriented polystyrene film 9 laminated to a border layer of polythene 10, such that the latter forms a "frame" around the edges of the oriented polystyrene layer 9. In use the border layer of polythene 10 is contacted with the lip of a polythene tray to form a seal.

It should be noted that different sealing layers could also be chosen and heavily perforated to laminate to selected barrier layers, such as OPS, to achieve different packaging functions. For example, a coated polyester layer perforated and laminated to OPS film could be used to seal to polyvinylchloride (PVC) and APET trays, or a cast, perforated polypropylene film to seal to polypropylene trays, etc. Moreover,

different barrier layers can be chosen to achieve desired permeability for gases and moisture and laminated to different sealing films to perform specific packing functions. For example, a thin OPP film, such as one having a thickness of 15 μm, can be laminated to a perforated polythene film. The character of the OPP film is maintained in this laminate, the resultant permeability being 3,000 $cm^3/m^2/day$ oxygen and 8-10 $gm/m^2/day$ of moisture. This sort of permeability is ideal for low moisture content vegetables, such as carrots, onions, salads, etc. In contrast, a laminate of OPS would be more suitable for high moisture content vegetables, such as broccoli and mushrooms. The sealing films according to the invention allow the final pack is totally sealed, such that microbes cannot enter the pack. In addition, the moisture permeability can be more precisely tailored. Furthermore, only two films would meet the packaging requirements of most vegetable packers: a low permeability film such as OPP and a high permeability film such as OPS. More specific requirements could be met by controlling the amount of perforations in the sealing layer.

Claims

1. A gas-permeable sealing film comprising a gas-permeable barrier layer and a sealing layer, wherein the sealing layer is adapted to attach the sealing film to an object without substantially reducing gas-permeability of the barrier layer.

2. A gas-permeable sealing film as claimed in claim 1, wherein the sealing layer overlays at least a portion of the barrier layer.

3. A gas-permeable sealing film as claimed in claims 1 or 2, wherein the sealing layer is substantially completely porous, such that the gas-permeability of the sealing film is determined mainly by the gas-permeability of the barrier layer.

4. A gas-permeable sealing film as claimed in claim 3, wherein the sealing film retains at least 70%, preferably at least 80%, most preferably at least 85%, of the gas-permeability of the barrier layer alone.

5. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the sealing layer is perforated, preferably micro-perforated.

7. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein at least a portion of the sealing layer is in the form of an open mesh or net.

8. A gas-permeable sealing film as claimed in claim 8, wherein substantially all of the sealing layer is in the form of an open mesh or net, the barrier layer being supported thereon.

9. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the sealing layer is laminated to the barrier layer.

10. A gas-permeable sealing film as claimed in claims 1 or 2, wherein the sealing layer is laminated to a sealing region of the barrier layer, such that a substantial portion of the barrier layer remains exposed.

11. A gas-permeable sealing film as claimed in claim 10, wherein the sealing region forms a peripheral region of the barrier layer.

12. A gas-permeable sealing film as claimed in claims 10 or 11, wherein at least 70%, preferably at least 80%, most preferably at least 85%, of the barrier layer remains exposed.

13. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the barrier layer is substantially impervious to microbes.

14. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the film has an oxygen transmission rate of from 1,500 cm^3/m^2/day to 50,000 cm^3/m^2/day, preferably from 2,000 cm^3/m^2/day to 25,000 cm^3/m^2/day, more preferably from 5,000 cm^3/m^2/day to 15,000 cm^3/m^2/day.

15. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the film has a moisture transmission rate of from 1 gm/m^2/day to 1000 gm/m^2/day, preferably from 5 gm/m^2/day to 500 gm/m^2/day, more preferably from 50 gm/m^2/day to 250 gm/m^2/day.

16. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the gas-permeable barrier layer comprises an oriented polystyrene or oriented polypropylene film.

17. A gas-permeable sealing film as claimed in any one of the preceding claims, wherein the sealing layer comprises a coated polyester film or a polythene film.

18. A gas-permeable sealing film substantially as described in the foregoing examples.

19. A method of forming a gas-permeable sealing film, comprising providing a gas-permeable barrier layer with a sealing layer that is adapted to attach the sealing film to an object without substantially reducing gas-permeability of the barrier layer.

20. A method of forming a gas-permeable sealing film as claimed in claim 19, wherein at least a portion of the barrier layer is overlaid with the sealing layer.

21. A method of forming a gas-permeable sealing film as claimed in claims 19 or 20, wherein the sealing layer is substantially porous, such that the gas-permeability of the sealing film is determined mainly by the gas-permeability of the barrier layer.

22. A method of forming a gas-permeable sealing film as claimed in claim 21, comprising the steps of providing a thin film of a sealing material and perforating the thin film to form a substantially porous sealing layer.

23. A method of forming a gas-permeable sealing film as claimed in claim 21, wherein the sealing layer is formed of an open mesh or net of a sealing material.

24. A method of forming a gas-permeable sealing film as claimed in claim 23, wherein the sealing material is woven to form an open mesh or net.

25. A method of forming a gas-permeable sealing film as claimed in claim 23, wherein the sealing material comprises a thermoplastic polymer that is set in the form of an open mesh or net.

26. A method of forming a gas-permeable sealing film as claimed in claims 19 or 20, wherein the sealing layer is applied to a peripheral region of the barrier layer, such that a substantial portion of the barrier layer remains exposed.

27. A method of forming a gas-permeable sealing film as claimed in any one of the preceding claims, wherein the sealing layer is laminated to at least a portion of the barrier layer.

28. A method of forming a gas-permeable sealing film as claimed in any one of claims 19-27, wherein the sealing layer is formed on the barrier layer by a partial coating technique.

29. A method of forming a gas-permeable sealing film substantially as described in the foregoing examples.

30. A gas-permeable sealing film formed by a method as claimed in any one of claims 19-29.

31. Use of a gas-permeable sealing film as claimed in any one of claims 1-18 and 30 as a packaging material for food products.

32. A packaged article comprising a gas-permeable sealing film as claimed in any one of claims 1-18 and 30.

Application No:	GB 9926280.0	**Examiner:**	R.J.MIRAMS
Claims searched:	1 to 32	**Date of search:**	25 January 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B5N, B2E

Int Cl (Ed.7): B32B. B65D.

Other: ONLINE: WPI, EPODOC, JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP0943427A1	(Mitsui Chemicals) e.g. column 4 lines 9 to 11	at least 1, 2, 4, 9, 13, 14, 15, 19, 20, 27 and 30 to 32
X,Y	EP0283920A2	(Hercules Inc.) e.g. page 2 lines 11 to 14 and 17 to 19	X at least 1, 2, 9, 13 to 17, 19, 20, 27 and 30 to 32 Y 10 to 12, 26 and 28
X	EP0243965A2	(Toyo Boseki) whole document	at least 1, 2, 5, 9, 13 to 15, 19, 20, 22, 27, 30 to 32

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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Claims searched: 1 to 32

Examiner: R.J.MIRAMS
Date of search: 25 January 2000

Category	Identity of document and relevant passage		Relevant to claims
X	US5885699A	(Watson) e.g. column 5 line 66 to column 6 line 2	at least 1, 2, 9, 13 to 15, 19, 20, 27, and 30 to 32
X	US5523136A	(Fischer) e.g. column 12 lines 15 to 27	at least 1, 2, 9, 13 to 15, 19, 20, 27 and 30 to 32
X	US4949847A	(Nagata) e.g. figure 11 and column 6 line 50 to column 7 line 18	at least 1 to 4, 9, 13 to 15, 19 to 21, 27 and 30 to 32
X	US4939030A	(Tsuji) e.g. examples	at least 1, 2, 9, 13 to 15, 19, 20, 27 and 30 to 32
X	FR2609930A1	(Richard-Laleu) see abstract	at least 1 to 5, 13 to 17, 19 to 22 and 30 to 32
X	JP080244847A	(Nidaiki) see abstracts	at least 1 to 5, 9, 13 to 16 and 19 to 22, 27 and 30 to 32
X	JP060270248A	(Showa Denko) see abstracts	at least 1, 2, 9, 13 to 16, 19, 20, 27 and 30 to 32

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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Claims searched: 1 to 32

Examiner: R.J.MIRAMS
Date of search: 25 January 2000

Category	Identity of document and relevant passage	Relevant to claims
X	JP050096690A (Dainippon) see abstracts	at least 1 to 4, 9, 13 to 15, 19, 21, 27 and 30 to 32

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